

What Is Claimed Is:

1. An apparatus for providing at least one of therapeutic heating and cooling to a body surface, comprising:
 - a wrap adapted to be secured to the body surface;
 - at least one temperature sensor mounted to said wrap to measure an actual temperature of the body surface;
 - at least one TE device mounted to said wrap to selectively deliver heat to and remove heat from the body surface; and
 - a control unit mountable to said wrap for receiving the actual temperature of the body surface from said at least one temperature sensor and for communication with said at least one TE device to operate said at least one TE device as one of a heater and a cooler, thereby achieving a desired temperature of the body surface.
2. The apparatus of claim 1, wherein said control unit is interchangeable with an other temperature control unit.
3. The apparatus of claim 1, wherein said wrap includes a first port that communicates with said at least one temperature sensor and said at least one TE device, and said control unit includes a second port for releasable connection with said first port for transmission of information from said control unit to said at least one TE device and for receipt of information from said at least one temperature sensor to said control unit.
4. The apparatus of claim 3, wherein said control unit is interchangeable with an other temperature control unit adapted to be releasably connected to said first port.
5. The apparatus of claim 1, wherein said wrap includes a pocket therein for carrying said control unit.

6. The apparatus of claim 1, further comprising a pressure sensor mounted to said wrap, said pressure sensor adapted to turn ON said control unit when said pressure sensor is activated.

7. The apparatus of claim 1, wherein said wrap includes a strap to attach said wrap to the body surface.

8. The apparatus of claim 1, wherein said wrap includes an inner layer facing away from the body surface and a lower layer facing toward the body surface, said at least one TE device is mounted between said upper and lower layers, said at least one temperature sensor is mounted to said lower layer, and said control unit is mounted to said upper layer.

9. The apparatus of claim 1, wherein said upper layer includes a strap to attach said wrap to the body surface.

10. The apparatus of claim 8, wherein said wrap further includes a first elastic layer positioned between said upper layer and said at least one TE device, and a second elastic layer and said at least one TE device, and a second elastic layer positioned between said at least one TE device and said layer.

11. The apparatus of claim 10, wherein said wrap further includes a first conductive layer positioned between said first elastic layer and said at least one TE device, and a second conductive layer and said at least one TE device, and a second elastic layer positioned between said at least one TE device and said layer.

12. The apparatus of claim 11, wherein said wrap further includes a first insulative layer positioned between said first conductive layer and said at least one TE device, and a second insulative layer and said at least one TE device, and a second conductive layer positioned between said at least one TE and said first and second conductive layers contacting said least one TE device to said first and second conductive layers.

13. The apparatus of claim 12, wherein said wrap further includes a wiring/tubing layer positioned between said first insulative layer and said at least one TE device, and a second insulative layer positioned between said at least one TE device and said layer.

14. The apparatus of claim 12, wherein said first and second elastic layers are formed of a ventilatory material.

15. The apparatus of claim 8, further comprising at least one pressure sensor mounted to said layer for transmission of information to said control unit.

16. The apparatus of claim 8, further comprising at least one electrode mounted to said lower layer for receipt of information from said control unit and for transmission of an electrical pulse to the body surface.

17. The apparatus of claim 1, further comprising at least one pressure sensor mounted to said wrap from receipt of information from said control unit.

18. The apparatus of claim 1, further comprising at least one electrode mounted to said wrap for receipt of information from said control unit and for transmission of an electric pulse to the body surface.

19. The apparatus of claim 12, wherein said second insulate layer and said wiring/tubing layer define therebetween at least one cavity for receipt of fluid.

20. The apparatus of claim 12, wherein said first insulate layer and said wiring/tubing layer define therebetween at least one cavity for receipt of fluid.

21. The apparatus of claim 19, wherein said at least one cavity comprises two cavities connected by a fluid passage.

22. The apparatus of claim 20, wherein said at least one cavity comprises two cavities connected by a fluid passage.

23. The apparatus of claim 1, wherein said at least one TE device comprises a Peltier device.

24. The apparatus of claim 1, wherein said wrap includes:
an upper layer facing away from the body surface;
a lower layer facing toward the body surface, said at least one temperature sensor being positioned on the lower surface of said lower layer;
a wiring/tubing layer in which said at least one TE device is connected;
first and second insulate layers respectively disposed on opposite sides of said wiring/tubing layer;
a first and second conductive layer disposed between said upper layer and said first insulate layer; and
a second conductive layer disposed between said lower layer and said second insulate layer;
a first elastic layer disposed between said upper layer and said first conductive layer; and
a second elastic layer disposed between said lower layer and said second conductive layer.

25. The apparatus of claim 24, further comprising at least one pressure sensor disposed on said lower surface of said lower layer.

26. The apparatus of claim 1, wherein said wrap includes
an upper layer facing away from the body surface;
a lower layer facing toward the body surface, said lower layer comprising a fluid transfer medium, said at least one temperature sensor being mounted to said fluid transfer medium;
a wiring/tubing layer in which said at least one TE device is connected;
first and second insulate layers respectively disposed on opposite sides of said wiring/tubing layer; and

a first conductive layer disposed between said upper and said first insulate layer;
a second conductive layer disposed between said lower and said second insulate layer;
a first elastic layer disposed between said upper and said first conductive layer;
a second elastic layer disposed between said lower and said second conductive layer.

27. The apparatus of claim 1, wherein said wrap includes:
an upper layer facing away from the body surface;
a lower layer facing toward the body surface, said lower layer comprising a fluid transfer medium, said at least one temperature sensor being mounted to said fluid transfer medium;
a wiring/tubing layer in which said at least one TE device is connected;
a layer therebetween at least one expandable cavity for filling with fluid;
first and second insulate layers respectively disposed on opposite sides of said wiring/tubing layer; and
a first conductive layer disposed between said upper and said first insulate layer;
a second conductive layer disposed between said lower and said second insulate layer;
a first elastic layer disposed between said upper and said first conductive layer;
a second elastic layer disposed between said lower and said second conductive layer.

28. The apparatus of claim 27, further comprising at least one pressure sensor disposed on the lower surface of said lower layer.

29. The apparatus of claim 27, further comprising at least one electrode disposed on the lower surface of said lower layer.

30. The apparatus of claim 27, further comprising at least one pouch disposed on the lower surface of said lower layer for placement of electrodes.

31. The apparatus of claim 27, further comprising a template for the location of electrode(s) on the body of user, and the appropriate pouch disposed on the lower surface of said lower layer by a clinician.

32. The apparatus of claim 1, wherein said control unit comprises:
a power source;
a controller;
a first switch, responsive to the actual temperature detected by said at least one temperature sensor, that turns off said power source when the actual temperature is above a maximum temperature or below a minimum temperature; and
a second switch electrically communicating with said at least one TE device and adapted to operate said at least one TE device to deliver heating or cooling;
said at least one TE device connected to receive a signal from said controller corresponding to the desired temperature and to deliver at least one of heating and cooling to the body surface in response to the desired temperature.

33. A device for achieving a desired temperature of a body surface, comprises:
a power source;
at least one temperature sensor that detects an actual temperature on the body surface;
a controller;
a first switch, responsive to the actual temperature detected by said at least one temperature sensor, that turns off said power source when the actual temperature is above a maximum temperature or below a minimum temperature;

at least one TE device connected to receive a signal from said controller corresponding to the desired temperature and to deliver at least one of heat and cooling to the body surface in response to the desired temperature; and

a second switch electrically communicating with said at least one TE device and adapted to operate said at least one TE device to deliver heating or cooling.

34. The device of claim 33, wherein said controller comprises a preprogrammed microprocessor having a manually selectable input element for adjustment of the desired temperature.

35. The device of claim 33, wherein said first switch comprises a digital thermostat, and said at least one temperature sensor is electrically connected to said digital thermostat.

36. The device of claim 33, wherein said at least one TE device comprises a Peltier device.

37. The device of claim 33, wherein said second switch changes a direction of current through said at least one TE device.

38. The device of claim 33, wherein said power unit comprises a power source and an on/off switch for activating and deactivating said power source.

39. The device of claim 33, wherein said power unit comprises a battery.

40. The device of claim 33, wherein said power unit comprises a fuel cell.

41. The device of claim 38, wherein said power source further comprises a voltage limiting circuit/device, in parallel with both said on/off switch and power source, to control voltage delivered by said power source.

42. The device of claim 33, wherein said controller comprises a microprocessor having memory that stores at least one program for adjusting the desired temperature over time.

43. The device of claim 42, wherein said microprocessor has an input/output interface that enables a clinician to modify time and temperature parameters of said at least one program to create a clinician-defined program.

44. The device of claim 43, wherein said at least one program comprises a plurality of programs having different time and temperature parameters, said plurality of programs being selectable by the clinician via said input/output interface.

45. The device of claim 42, wherein said microprocessor is connected to said first and second switches and said at least one temperature sensor for receipt of a signal indicative of the actual temperature.

46. The device of claim 42, further comprising a heart rate sensor unit including an ultra miniature microphone connected to said preamp, an active switched capacitor filter connected to said preamp, at least one amplifier connected to said active switched capacitor filter, at least one digitizer connected to said amplifier, and a microprocessor connected to said digitizer.

47. The device of claim 42, wherein said microprocessor is connected to said at least one breathing rate sensor for receipt of a signal indicative of the user's actual breathing rate.

48. The device of claim 42, further comprising an electrical stimulation unit, connected to said microprocessor, for delivery of an electrical pulse to the body surface.

49. The device of claim 48, wherein said electrical stimulation unit comprises a waveform generator connected to said microprocessor, a modulator unit connected to said waveform generator, a driver connected to the modulator, and at

least one electrode connected to said driver to deliver the electrical pulse to the body surface.

50. The device of claim 33, further comprising a current limiting circuit/device connected to said power unit and said first switch to control an amount of current passing through said device.

51. The device of claim 48, further comprising an iontophoresis unit, connected to said microprocessor, for delivery of medication to the body surface.

52. The device of claim 51, wherein said iontophoresis unit comprises a medication interface unit connected to said microprocessor, a medication controller unit connected to said medication interface, a medication dispenser connected to the medication controller, and at least one special electrode connected to said medication dispenser to deliver the medication to the body surface.

53. The device of claim 49, further comprising of an evoked response detection unit including an ultra miniature microphone connected to said preamp, an active switched capacitor filter connected to said preamp, at least one amplifier connected to said active switched capacitor filter, at least one digitizer connected to said amplifier, and a microprocessor connected to said digitizer.

54. The device of claim 46, further comprising a data link unit, connected to said microprocessor, for transfer of information to and from the microprocessor.

55. The device of claim 54, wherein said data link unit comprises an input/output interface connected to said microprocessor, a data input/output processor and an input/output connector connected to said input/output interface, and a transceiver connected to said input/output processor to transfer data to a remote computer.

56. The device of claim 54, further comprising a remote computer unit, connected to said device, for processing of information to and from the apparatus microprocessor.

57. The device of claim 56, wherein said remote computer unit comprises a transceiver connected to said signal processor, an input/output unit connected to said signal processor, and a computer connected to said input/output unit to process and transfer data to the apparatus.

58. An apparatus for providing a therapeutic treatment to the body surface, comprising:

- a wrap adapted to be secured to the body surface;
- at least one temperature sensor mounted to said wrap to measure an actual temperature of the body surface;
- at least one TE device mounted to said wrap to selectively deliver heat to and remove heat from the body surface;
- at least one electrode mounted to said wrap to deliver an electrical pulse to the body surface;
- at least one special electrode mounted to said wrap to deliver medication to the body surface;
- a controller mountable to said wrap for receiving the actual temperature of the body surface from said at least one temperature sensor and for communication with said at least one TE device and said at least one electrode and said at least one special electrode simultaneously, thereby simultaneously medicating, electrically stimulating, and selectively delivering heat to and removing heat from the body surface.